A CLINICAL EFFICACY OF DIETARY REGIME (MILLETS) IN MADHUMEHA (TYPE-2 DIABETES MELLITUS)

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ABSTRACT

Background: Diabetes Mellitus has turned out to be the considerable silent killer today within the world. Diabetes Mellitus can be correlated with an identical disease delineated in Ayurveda as *Madhumeha. Madhumeha* is a clinical entity described in Ayurveda under the types of *Vataja Prameha*, and can be managed conservatively with Modifications in diet, exercise, medication and lifestyle are all important factors in successful treatment of type 2 diabetes and are assimilated into the ancient Indian medicinal practice of Ayurveda. **Aim:** The aim is to evaluate the efficacy of dietary regime in *Madhumeha* (Type 2 Diabetes Mellitus) **Materials and methods:** 50 patients were screened for the assessment from outpatient department (OPD) of Kayachikitsa patients with Diabetes type 2 and on the basis of CRF-1 (Case Report Form 1), Among them 05 were excluded as they were not meeting the inclusion criteria. Total 45 subjects 23 were allocated for intervention in Group A and 22 patients were in Group B. In Group A (Trial Group)-*Chandraprabha along with dietary regime* was given dosage of 2 tablet (each 5oomg) twice in a day for 21 days an hour before meal with lukewarm water. In Group B (Comparator Group)-*Chandraprabha Vati[19]* was given dosage of 500 mg twice in a day for 21 days half an hour before meal with lukewarm water . The data in the clinical study was analyzed by applying appropriate statistical methods including Chi-square/ Fisher Exact test for subjective criteria and Student's paired t-test for objective criteria. **Results:** After analyzing the data Group A, shown Significant reduction was seen in raised FBS Level in first week (p value <0.05) and last 14 days of treatment and the mean PPBS was reduced significantly at Day 7, Day 14 and Day 21 (p<0.05). In Group B, the mean FBS was reduced significantly between Day 7 and Day 14 (p<0.05) & Baseline to Day 21 (p<0.05), while the mean PPBS was reduced significantly from baseline to Day 7(p=0.001), Day 14 to 21 (p=0.01), but insignificant between Day 7 & Day 14 (p=0.2). **Conclusion:** Dietary regime with *Chanadrparabha Vati* had quite a significant impact on reducing the PPBS, urine (sugar) levels, and symptomatic relief in type-2 DM patients. But in on other group subjective *Param*eters only *Chandraprabha Vati* showed fine results. However, in reducing the FBS levels both groups were equally effective.

KEYWORDS: Ayurveda, Dietary Regime, Diabetes Mellitus, Millets, *Prameha*. Pathya

INTRODUCTION

Diabetes and its complications account for a massive hazard to future public health resources all over the globe. Globally, approximately 422 million adults are suffering from Diabetes Mellitus, according to the latest 2016 data of World Health Organization. Prevalence of Diabetes Mellitus is increasing quickly; the previous year of 2013 from the International Diabetes Federation put the number at 381 million people having Diabetes. The number is projected to be almost double by 2030.[1] Diabetes Mellitus (DM) refers to a group of metabolic disorders c*Hara*cterized by chronic hyperglycemia, polyuria, polydipsia, polyphagia, emaciation, and weakness due to disturbance in carbohydrate, fat and protein metabolism associated with relative or absolute deficiency in insulin secretion and/or insulin action[2]. Similar disease has been described in Ayurveda as *Prameha. Prameha* has mentioned that it is a group of disorders in which there is increased frequency of micturition, the volume of urine is also increased and the urine becomes turbid. Acharyas have explained that in *Madhumeha* there is vitiation of *Kapha Pradhana Tridosha* associated with *Meda* and other *Dhatus* along with *Ojas* as

Dushya which comes out of the body through *Mutravaha Srotas*. At present time, ongoing management of Type2 Diabetes Mellitus is still not so satisfactory and disappointing, both in halting, and in preventing its pathophysiology, and modifying its progression. In addition, reported to have side effects on long term use. Hence, there is the necessity to look for effective and safe source of herbal as well as dietary remedies mentioned in Ayurveda classics.

Aims and objectives:

To evaluate the efficacy of dietary regime in *Madhumeha* (Type 2 Diabetes Mellitus).

MATERIAL AND METHOD:

Permission for this clinical study had been taken from the Institutional Ethical Committee with IE code-F1(553)/13/CBPACS/Adm/IEC/3214-17 Dated 07/09/2019 and also registered in Clinical Trial Registry of India (CTRI; www.ctri.nic.in) vide registration number for this trial is CTRI/2020/02/023430 dated 19/03/2020.

Study Design- Single centered, open label, parallel group, Randomized control study, Efficacy study.

Study Population: Diagnosed patients of Type-2 Diabetes Mellitus will be selected for this purpose on the basis of inclusion criteria. A total of 45 patients were included in the trial out of which 5 patients left the trial in the middle due to Lockdown and some of their personal unavoidable circumstances and turned out to be the dropouts, and hence forth a sumtotal of 40 patients (excluding the dropouts) completed this clinical trial wherein two groups were already segregated on the basis of the drug been administered i.e., Group A been given *Chandraprabha Vati along with dietary regime* and Group B administered *Chandraprabha Vati*. Duration of the study was 42 days including 21 days of follow up. Subjects were only advised to follow up dietary regime during the follow up period.

Initial screening of patients was carried out in the outpatient department (OPD) of *KayaChikitsa* based on presence of subjective symptoms & raised Blood Sugar levels in patients of Diabetes type 2 and on the basis of CRF-1 (Case Report Form 1). A total of 50 people were assessed for eligibility; among them 05 were excluded as they were not meeting the inclusion criteria. Total 45 subjects were put to randomization with the intention to complete minimum 20 in each group. In group A, 23 were allocated for intervention and in group B, there were 22 patients. Excluding the dropouts, a total of 40 patients; 20 in each group completed the follow-up and the data was analyzed statistically.

DIAGNOSTIC CRITERIA
According to the American Diabetes Association (ADA) criteria for the diagnosis of diabetes A hemoglobin A1c (HbA1c) level of 6.5% or higher; the test should be performed in a laboratory using a method that is certified by the National Glycohemoglobin Standardization Program (NGSP) and standardized or traceable to the Diabetes Control and Complications Trial (DCCT) reference assay. Diagnosis was done on the basis of Fasting plasma glucose (FPG) level of 126mg/dl (7mmol/l)or higher; fasting is defined as no caloric intake for at least 8 hours, or 2-hour plasma glucose level of 200mg/dl (11.1mmol/l)or higher during a 75-g oral glucose tolerance test(OGTT),or Random plasma glucose of 200mg/dl (11.1mmol/l) or higher in a patient with classic symptoms of hyperglycaemia (i.e., polyuria, polydipsia, polyphagia, weight loss) or hyperglycaemic crisis[22].

Inclusion Criteria
Patients with age between 40-60yrs, Both male and female, Patients fulfilling the diagnostic criteria for Diabetes Mellitus framed by the AMERICAN DIABETES ASSOCIATION. Patients with FBS-126-200mg/dl PPBS-180-350mg/dl, HbA1c 7% and more were included. Patients taking any type of oral anti-diabetic treatment from like. Biguanides and Sulfonylurea were included.

Exclusion Criteria: Patients below the age of 40 years and more than the age of 60 years, Fasting Blood Sugar Level <126 mg/dl and >200 mg/dl, PPBS <180 mg/dl and >350 mg/dl, HbA1c <7% were excluded. Those who are depending on insulin for blood glucose control, having diabetic complications, suffering from Secondary Diabetes, Gestational diabetes, Pregnant ladies and lactating mothers were excluded..

Withdrawal Criteria:
Patients developing any serious adverse effects, Deteriorations of the condition of the patients after taking treatment and Patients not willing to continue in study.

Assessment Criteria: Subjective Criteria are *Prabhootmutrata, Avilamutrata, Mutra Madhuryata, Swapnasheela, Aasansheela, Atikshudha, Atisweda, Daurbalya, Atitrushna* and Objective Criteria is FBS and PPBS and Urine (routine and microscopic).

Laboratory Investigation: Assessment of Blood Glucose levels both FBS and PPBS, Glycated Hemoglobin (HbA1c), Serum creatinine was done. In Urine investigation Routine, Microscopic Examination was done

Detail Of Drug Administration: In Group A (Trial Group) Along with dietary regime *Chanadraprabha Vati* 2 tablet each of 500mg half an hour before meal and in Group B (Comparator group) *Chandraprabha Vati* was given in same dose twice in a day for 21 day. Table no-1

Diet	Early Morning	A glass of *Gavedhukamantha* ***Method of preparation:*** soak2 to 3 tea spoon of powdered roasted *Gaveduka (coix lacryma Jobi* in a glass of warm water for half an hour and then churn this liquid, filter and drink
	Morning Break-fast	1- 2 dry chapatti made from *Kangu (foxtail millet) floor* or 1 bowl of boiled green gram or splitted Bengal gram with slight rock salt, turmeric and pepper
	Mid-day meal	Before commencing the meal, a bowl of Shyamaka (echinochloa frumentacea) Pulao with green vegetables i.e bottle gourd may be taken. Other preferable vegetables for preparing soup are cabbage, radish, spinach, drumstick, pumpkin, Amla(-gooseberry). 2 – 3 small chapattis made from kodrav flour ,cup of Moong Dal. 1 small bowl of vegetable prepared with Fenugreek seeds,ginger,Garlic and onions. Vegetables advised to be taken are bitter gourd, cabbage, drum sticks,bottle guard, ridge gourd, Parval,brinjal,kankoda, methi (fenugreek leaves)
	Afternoon / Early evening	1 glass of Yavamantha
	Dinner	1 small cup of *Moong dal Soup* Khichadi made from Samo / Kodaro

Table 1: Dilatory regime advised to patient

Groups	Number of Patients	Total Duration
A. Trial Group	20	42 days (21 days drug administration + 21 days follow up)
B. Comparator Group	20	42 days (21 days drug administration +21 days follow up)

Table 2: Interventions on trial

Patients were clinically assessed on day 0,1,7,14,21 days for efficacy and findings noted in specified proforma and follow up of the subjects were done after 21 days the Dietary regime was advised. The response of the patient's diseased condition will be observed and recorded before, during and after the treatment in a specially designed case proforma includes detailed history, physical examination, laboratory investigations and assessment based on subjective and objective *Param*eters for which appropriate scoring pattern is adopted.

Statistical Analysis: The data in the clinical study was analyzed by applying appropriate statistical methods. Chi-square/ Fisher Exact test for subjective criteria and Student's paired t-test for objective criteria were applied to check the level of significance in a single group before and after treatment, while Student's unpaired t-test for objective criteria was applied to assess the level of significance of difference observed between two groups.

Observations
Out of the total subjects randomized the proportion of males was more than females. The distribution of male and female was the same in both groups which were 15 male and 5 female. The ratio of F: M was 1:3. The predominance of Type2 Diabetes Mellitus in the age group of 50-60 years (62.5%) followed by the age 40-49 years (37.5%) signifies the direct correlation of age with the development of disease pathologies in Type2 DM. Maximum numbers of patients belonged to Hindu religion. Overall the proportion of Hindus, Muslims & Christian in the study was 92.5%, 5% and 2.5% respectively. In group A this proportion was 90%, 5% & 5% while in group B this proportion was 95%, 5% and 0.0% respectively. In this study it was observed that vegetarians were in abundance but there was a definite proportion of the lacto-vegetarians which might be in order to compensate for their calories of protein by taking dairy products like ghee, milk, yoghurt, etc. carbohydrate and fat rich food articles. Distribution of education qualification was similar between both groups with the predominance of illiterate patients in both groups. The presence of anxiety in this population of both the groups is suggestive of the kind of lifestyle measures being adopted wherein there is a sheer lack of moving out of their usual spaces. Most of the patients were indulged in sedentary lifestyle practices with habit of *Diwaswapna, Adhyaashana*, and sedentary lifestyle along with less outdoor activities. Majority of patients were found to be of *Vata-Kapha Prakriti* followed by *Vata- Pitta* and then *Pitta Kapha*. *Prameha* is *Santarpana janya vyadhi* and those with the *Vata Kapha Prakriti,* this type of *Prakriti Purusha* will consume more *Dadhi* (Curd), *Madhura Rasa Aahar* etc. *Nidana* and will follow a sedentary lifestyle so they are more prone

for Type2 Diabetes Mellitus. The constipation problem was present in 42.5% cases overall, 45% cases in group A and 400% cases in group B. Baddhapurishatva is one of the complications of *Prameha*. Long standing DM may affect the motility and function of the GI system. The smoking habit was present in 10% cases overall, in both groups it was 10%. Smoking is a risk factor for the development of Type II DM, may predispose to microvascular and other complications and is associated with poor glycaemic control. The tobacco chewing habit was present in 2.5% cases overall that belongs to group A. The drinking habit was present in 2.5% cases overall, all from the group. Moreover the frequent intake of Tobacco, Cigarette and Alcohol may derange the metabolism. At day 1 polyuria was present in 60% cases total, which after day 21 was decreased to 25%. Significant changes were seen in both the groups before and after treatment (p<0.05). At day 1 polydipsia was present in 40% cases in total, 35% of which were from group A and 45% cases of group B, which after Day 21 reduced to 7.5% cases in total, 5% of which were from group A and 10% from group B. At day 1 exhaustion was present in 72.5% cases in total, 80% of which were from group A and 65% cases of group B, which after Day 21 reduced to 22.5% cases in total, from which 15% are from group A and 30% in group B. At day 1 loss of body weight was present in 27.5% cases in total, 15% of which were from group A and 40% cases of group B, which after Day 21 reduced to 2.5% cases in total, from which 0.0% are from group A and 5% in group B. At day 1 loss of body ache was present in 65% cases in total, 65% of which were from group A and 65% cases of group B, which after Day 21 reduced to 25% cases in total, from which 15% are from group A and 35% in group B. At day 1 Giddiness was present in 27.5% cases in total, 25% of which were from group A and 30% cases of group B, which after Day 21 reduced to 5% cases in total, from which 5% are from group A and 5% in group B.

RESULTS
Group A *chandraprabha* along with dietary regime) and Group B (*Chandraprabha Vati*) both showed to reduce the blood sugar levels. It is inferred from the study that Group A is more effective in maintaining the Post Parandial blood sugar levels to normal and thereafter when intervention was stopped no abrupt hike in blood sugar was noted whereas, Group B is helpful in reducing blood sugar levels till then it is consumed. Both the groups showed significant improvement in reduction of blood sugar level on testing FBS & PPBS assessment but group A was more effective in reducing the subjective as well as the objective symptoms of TYPE 2 DM than group B. (Table 1 & 2). Significant changes were found in Urine sugar levels in groups group A (p<0.05) only, but not in group B (p>0.05) (Table 2)

Fasting blood sugar levels	Paired - t test value	P Value	Result
Between baseline and day 7	2.989012	0.007543	Significant
Between Day 7 and Day 14	0.252001	0.803746	Insignificant
Between Day 14 and Day 21	2.977695	0.007734	Significant
Before and after treatment (day 1 & day 21)	4.130719	0.000568	Significant

Table 2 (A): Comparison of fasting blood sugar within the group A

Fasting blood sugar levels	Paired T test value	P - Value	Result
Between baseline and day 7	1.90816	0.071598	Insignificant
Between Day 7 and Day 14	2.699883	0.014193	Significant
Between Day 14 and Day 21	2.011902	0.058629	Insignificant
Before and after treatment (day 1 & day 21)	3.8696	0.001032	Significant

Table 3 (A): Comparison of blood sugar statistical analysis within the group B

Post prandial blood sugar levels	Paired- t test value	p- Value	Result
Between baseline and day 7	3.131569	0.005494	Significant
Between Day 7 and Day 14	2.202603	0.04017	Significant
Between Day 14 and Day 21	6.425735	3.68E-06	Significant
Before and after treatment (day 1 & day 21)	11.83383	3.28E-10	Significant

Table 2 (B): Intra group Comparison of Post prandial blood sugar within the group A

Post prandial blood sugar levels	Paired T test value	P - Value	Result
Between baseline and day 7	3.579841	0.001998	Significant
Between Day 7 and Day 14	1.327031	0.200226	Insignificant
Between Day 14 and Day 21	2.853955	0.010154	Significant
Before and after treatment (day 1 & day 21)	6.861363	1.5106	Insignificant

Table 3 (B): Comparison of Post-prandial blood sugar within the group B

Urine sugar levels		Mean	Median	SD	Paired t test value	P- Value	Result
Group A	Day 1	0.315	0	1.91	2.17945	0.042086	Significant
	Day 21	0.15	0	0.364			
Group B	Day 1	0.35	1	0.572	2.03235	0.056337	Non-significant
	Day 21	.1	0	3			

Table 4: Difference in statistical values of Urine sugar levels before and after treatment

No significant difference was found in mean FBS between the groups at Day 0 (p=0.150), Day 7 (p=0.215), Day 14 (p=0.081) and Day 21 (p=0.070) (Table 5). Significant difference was found in mean PPBS between the groups at Day 7(p=0.02), and Day 14 (p=0.007) but no significant improvement was seen in mean PPBS between the groups at Day 21 (p=0.829) (Table 6).

Fasting blood sugar	Group A			Group B			t- value	p- value
	Mean	Median	SD	Mean	Median	SD		
Day 0	189.5	185.5	28.294	169.8	159.5	48.139	1.47694	0.150
Day 7	175.5	179	28.711	160	156	36.962	1.26174	0.215
Day 14	173.7	172	32.223	151.35	141	38.187	1.795648	0.081
Day 21	159.7	159	27.313	141.15	126.5	34.688	1.86941	0.070

Table no. 5: Intergroup Comparison of FBS between the Groups.

Fasting blood sugar	Group A			Group B			t- value	p- value
	Mean	Median	SD	Mean	Median	SD		
Day 1	297.4	295	27.49	239.6	249.5	42.76	4.955849	2.26E-05
Day 7	264.8	259	48.50	217.55	221	41.799	3.216638	0.002695
Day 14	248.45	250	42.379	210.9	219.5	39.224	2.834408	0.007313
Day 21	200.25	182	41.58	203.05	198	38.082	-0.21643	0.829807

Table no. 6: Intergroup Comparison of PPBS between the Groups

In Group A, Significant reduction was seen in raised FBS Level in the first week (p value <0.05) and last 14 days of treatment and the mean PPBS was reduced significantly at Day 7, Day 14 and Day 21 (p<0.05). In Group B, the mean FBS was reduced significantly between Day 7 and Day 14 (p<0.05) & Baseline to Day 21 (p<0.05), while the mean PPBS was reduced significantly from baseline to Day 7(p=0.001), Day 14 to 21 (p=0.01), but insignificant between Day 7 & Day 14 (p=0.2). No significant difference was found in mean FBS between the groups at Day 0 (p=0.150), Day 7 (p=0.215), Day 14 (p=0.081) and Day 21 (p=0.070). But change in PPBS was found to be significantly more in Group A than Group B at Day 7(p=0.02), and Day 14 (p=0.007). Significant changes were found in Urine sugar levels in groups group A (p<0.05) only, but not in group B (p>0.05).

Discussion

Madhumeha is a type of *Vataja Prameha* which is a disease of *Mutravaha Srotas* having *Kapha* dominance which can be correlated with Type 2 Diabetes Mellitus. Type2 Diabetes Mellitus (DM) refers to a group of metabolic disorders c*Hara*cterized by chronic hyperglycemia, polyuria, polydipsia, polyphagia, emaciation, and weakness due to disturbance in carbohydrate, fat and protein metabolism. The symptoms similar to that of Type2 DM are found in various places in the form of symptoms of other diseases like *Karapada Daha* (burning sensation on palms and soles), *Suptata* (numbness) and *anga shithilta* (weakness in muscles). Excessive intake of *Kapha* and *Meda Vardhaka Ahara* and *Vihara* like *Diwaswapna*, *Asyasukha* (sedentary life), *Avyayama* (absence of exercise) such factors which are nothing but the *Santarpanjanya Nidana* of the disease. Some patients who were doing regular exercise and taking diet regularly still developed *Prameha*. This signifies that causative factors other than *Santarpana* have a role in the development of *Prameha*.

Dietary regime which help to correct deranged metabolism by their *Kaphamedahara* property and nourish body elements by their properties, have a role in the treatment of *Madhumeha*. *Madhumeha* can be prevented through dietary modification or diet control, and control of overweight and obesity along with appropriate use of Ayurvedic preventive measures such as *Aharavidhi*. Patients who keenly observed all the dietary intakes that were advised as per trial showed highly significant improvement in the symptoms and hence their way of living and abilities to perform the routine activities have improvised. The age group for selection was fixed as 40-60 years.

Mode of Action of The Given Treatment:

The results concluded that the *Dietary regime along with Chanadraprabha* had quite a significant impact on reducing fasting blood sugar levels, urine (sugar) levels, and symptomatic relief as well, not just owing to the p values but the kind of positive response received from the patients. But in some of the symptomatical *Param*eters *Chandraprabha vati* showed fine results which have become mandatory to be taken in consideration.

Chandraprabha vati is the drug of choice in case of *Madhumeha*.

The main contents of *Chandraprabha vati* are *Shilajit*, *Guggulu*, *Swarnamakshika Bhasma, Lavana* and *Kshara* are having key role to play in the action of drug. *Shilajit* is well known for its *Rasayana* and *Vayasthapana* action is better in the disease related to old age. The properties like *Medohara, Krimighna, Kaphahara* and *Lekhana* will helps in minimizing the symptoms caused due to *Aavarana*. Also having Medhya & *Smritivardhak* action, this corrects the pituitary functions. The *Guggulu* that is known for *Shothaghna*, *Lekhana*, *Krimighna* and *Yogavahi* helps to relive obstructive symptoms and channelizes the srotas and removes *Aavarana* and leads to reduction in the level of *Dusta dosha* & *Dushya* levels so ultimately helps in reduction of raised blood sugar. Complimented action of herbal drugs will contribute further for the action of *Chandraprabha Vati*. *Chandraprabha vati* is having *Tridoshahara, Balya, Vrishya* properties may does the action on *Kaphaavrita Vata* ; relieves the *Avrita Apana Vayu* and maintains the patency to normal flow and also does the *Rasayana* effect. These properties may help in reducing the blood sugar level. *Teekshna, Laghu* and *Sara guna* of is *Srotoshodhaka* (patent the channels). *Katu rasa* and *Ushna Veerya* is helpful in mitigating *Kapha* and *Meda (Kapha Medahara)*. Also, it's *Vyadhi Prabhava* and *Madhura rasa Bala*nces *Vata* and restores its physiological movements in the body at the cellular and tissue level.

Analysing the general qualities and effects of millets gives an obvious idea that millets are best advised in *Kaphaja Roga* (diseases due to *Kapha*), *Pittaja Roga* (diseases due to *Pitta*) and *Raktadushti* (vitiation of blood). Based on this understanding the gross indications for use of millets are, *Sthoulya* (obesity), *Kushta* (skin diseases), *Prameha* (Diabetes), *Atisaara* (Diarrhea), *MedoRoga* (Diseases due to excessive lipids), *Vrana* (wounds and ulcers) and other *Santarpanajanya Vyadhi* (diseases due to over nourishment of single or multiple tissues) which are usually lifestyle disorders. [4][5] Study reported that Millets are beneficial in chronic conditions like Obesity and Diabete Mellitus. [6,7]

Advising millets as per individual's *Agni Bala* (Digestive capacity) is also very important as they are *guru* (Heavy) and *Ruksha* (dry) which makes them difficult (*Durjara*) for easy digestion due to more amount of dietary fibre, protein and less quantity of carbohydrates compared to other cereals.[8][9] But both these qualities give an added benefit of satiety for a long time and they have *Lekhana* (Scraping) and *Kledashoshana* (dries up excessive moisture) action which is useful in treating *Santapanajanya Vyadhi* (diseases due to over nourishment of single or multiple tissues). Though millets are heavy for digestion, it is mentioned as (Lightness) in general qualities which can be understood as the after effect of proper digestion of millets on the body is, it imparts lightness.

The specific indications of each millet are not mentioned but, looking at their *Guna* (properties) and *Karma* (Actions), indications can be derived.

1. *Kangu* (Foxtail millet) which is *SanGrahi* (absorbs excessive fluids and helps for normal formation of faeces and enhances digestion) can be indicated in *Atisara*

(Diarrhea), *Grahani* (Irritable Bowel Syndrome). *Kangu* is both *Brumhana* (Nourishing) and *Shoshana* (dries up excessing moisture) which means it can be used for *Dhatu Shoshana* (reduction of body tissues) of over nourished *Dhatu*s like *Meda* (Adipose tissue) and *Mamsa* (Muscle tissue) meanwhile it can also provide nourishment by supplying micro-nutrients.[10] This principle works best in conditions like *Sthoulya* (Obesity) and *Prameha* (Diabetes Mellitus).[11] It reported on blood glucose level reduction in type 2 Diabetes on using multi-millet therapeutic food which includes Foxtail tail millet too.

2. 2) *Shyamaka* (Barnyard millet) can be indicated in *Atisara* (Diarrhea), *Grahani* (Irritable Bowel Syndrome) as it is *SanGrahi* (absorbs excessive fluids and helps for normal formation of faeces and enhances digestion) , *Badda Vitkara* (compactness of faeces), *Santarpana Janya Vyadhi* (Diseases due to over nourishment) like *Sthoulya* (Obesity), *Prameha* (Diabetes Mellitus), *MedoRoga* (Diseases due to excessive lipids) as it is *Shoshana* (Dries up excessive moisture), *Ruksha* (Reduces unctuousness), *Badda Mutrakara* (Promotes normal formation of urine), *Lekhaniya* (Scraping), other *Kapha-Pitta Pradhana Roga*s (Diseases due to vitiated *Kapha* and *Pitta*) like *Twak Vikara* (Skin Diseases), *AmaVata* (Rheumatoid Arthritis) are also indicated. Joshi S et al. (2016)[12] reported a low glycemic index of Barnyard millet rice which is useful in controlling Diabetes Mellitus.

3. 3)*Koradusha*/*Kodrava* (Kodo millet) is indicated in *Grahani* (Irritable Bowel Syndrome) due to *Param Grahi* (absorbs excessive fluids and helps for normal formation of faeces and enhances digestion), *Badda Vitkara* (compactness of faeces), *Vrana* (Wound and ulcers) and *Santarpana Janya Vyadhi* (Diseases due to over nourishment of body tissues) like *Sthoulya* (Obesity), *Prameha* (Diabetes Mellitus), *MedoRoga* (Diseases due to excessive lipids) due to *Kleda Shoshana* (Dries up excessive moisture), *Ruksha* (Reduces unctuousness), *Lekhana* (scraping), *Vatarakta* (Increases *Vata*), due to *Pitta-Rakta Shamaka* (Pacifies vitiated *Pitta* and Blood), *Vishartha* (Affected due to poison) as it is *Visha Hara* (Pacifies effects of poison) and other *Kapha-Pitta Pradhana Roga* (Diseases due to vitiated *Kapha* and *Pitta*). Chauhan M et al. (2018) reported the usefulness of millets in preventing Cardio-vascular diseases.[13]

4. 6) *Gaveduka* (Adlay millet) can especially be indicated in *Sthoulya* (Obesity) and *Sthula Pramehi* (Diabetes mellitus which leads to overweight) and other *Kapha Pradhana Vyadhi* (Diseases due to *Kapha*) as it is *Karshyakaari* (Imparts weight loss), *Kapha Hara* (Pacifies *Kapha*). [14] Study reviewed Adlay millet and mentioned its use in Diabetes, Rheumatism etc.

5. 7) *Yavanaala* (sorghum) is best advised in *Raktapitta* (Bleeding disorders), *Amlapitta* (Gastric disturbances), *Twak Roga* (Skin diseases) as it is *Pittaghna* (Pacifies vitiated *Pitta*), *Rakta Shamaka* (Pacifies vitiated *Pitta*), *Trishna* (Thirst), *Sthoulya* (Obesity), *Prameha* (Diabetes Mellitus)

as it is *Tikta-Kashaya* in *Rasa* (Bitter and Astringent in taste), *Trishnaghna* (Pacifies thirst), *Kaphahara* (Pacifies *Kapha*).[15] Research reported Sorghum as a potential source of nutrients and phytochemicals also reported on anti-obese and the anti-diabetic properties of Sorghum.[16]

CONCLUSION

The market has a number of modern day anti diabetics which the common man is consuming regularly for his solution to type 2 diabetes. The masses are unaware of the side effects these drugs have on their body after their prolonged consumption. Ayurveda offers herbal solutions addressing the need for overall well-being and improvement in general health along with freedom from the disease. The article throws light upon the dietary regime on type 2 diabetes on which further research is needed..

Limitation of study- A large sample size drawn from a larger population would have been more beneficial and statistically significant

REFERENCES

1. Available from: Wikipedia.org/wiki/Epidemology Of Diabetes Mellitus[Internate] https:// Wikipedia.org/wiki/Epidemology Of Diabetes Mellitus [last access-26 feb 2023].
2. Kasper D L, Fauci A.S., Hauser S.L., Longo D.L., Jameson J.L., Loscalzo J. et.al, Harrisons Principle of Internal Medicine, Diabetes Mellitus: Diagnosis, Classification and Pathophysiology, McGraw-Hill Companies,19th Edition,2015, Vol II, 417:2399
3. Bhavamishra. Dhanya varga. In: Srikantha Murthy,K.R (ed.) Bhavaprakasha. Varanasi: Chowkhamba Krishna Das Academy; 2011. p. 374-377
4. Acharya kaiyadeva. Dhanya varga. In: Prof priya vrat sharma, Dr guru prasada sharma (eds.) Kaiyadeva Nighantu (Pathyaapthya vibhodika). Varanasi: Choukambha Orientalia; 2009. p. 318-321.
5. Sarita ES, Singh E. Potential of millets: nutrients composition and health benefits. Journal of Scientific and Innovative Research. 2016;5(2):46-50.
6. Polkampally S. HEALTH: Millet Use Against Modern Medications to Treat Obesity and Diabetes.
7. Obilana AB, Manyasa E. Millets. InPseudocereals and less common cereals 2002 (pp. 177-217). Springer, Berlin, Heidelberg.
8. Geervani P, Eggum BO. Nutrient composition and protein quality of minor millets. Plant Foods for Human Nutrition. 1989 Jun 1;39(2):201-8.
9. Wahnschaffe U, Schulzke JD, Zeitz M, Ullrich R. Predictors of clinical response to gluten-free diet in patients diagnosed with diarrhea-predominant irritable bowel syndrome. Clinical Gastroenterology and Hepatology. 2007 Jul 1;5(7):844-50.
10. Vazquez–Roque MI, Camilleri M, Smyrk T, Murray JA, Marietta E, O'Neill J, Carlson P, Lamsam J, Janzow D, Eckert D, Burton D. A controlled trial of gluten-free diet in patients with irritable bowel syndrome-diarrhea: effects on bowel frequency and intestinal function. Gastroenterology. 2013 May 1;144(5):903-11.
11. Anitha S, Govindaraj M, Kane-Potaka J. Balanced amino acid and higher micronutrients in millets complements legumes for improved human dietary nutrition. Cereal Chemistry. 2020 Jan;97(1):74-84.
12. Nayak S, Meti R. Development of multi-millet therapeutic food product for Type II diabetes.
13. Joshi S, Srivastava S. Barnyard millet as a substitute of rice in preparation of khichdi for diabetics. Int J Sci Res. 2016;5(6):1798-802.

14. Chauhan M, Sonawane SK, Arya SS. Nutritional and nutraceutical properties of millets: A review. Clinical Journal of Nutrition and Dietetics. 2018;1(1):1-0.

15. Lucy OF, Ifedayo OA. Guinea Corn (Sorghum vulgare) Leaf, a Potential Source of Nutrients and Phytochemicals. Food and Public Health. 2012;2(6):228-30.

16. Shen RL, Zhang WL, Dong JL, Ren GX, Chen M. Sorghum resistant starch reduces adiposity in high-fat diet-induced overweight and obese rats via mechanisms involving adipokines and intestinal flora. Food and Agricultural Immunology. 2015 Jan 2;26(1):120-30.